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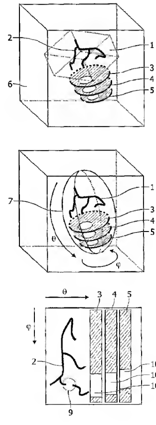
(54) Title: METHOD FOR THE COMPUTER-ASSISTED VISUALIZATION OF DIAGNOSTIC IMAGE DATA



(57) Abstract: The invention relates to a method for the computer-assisted visualization of a three-dimensional anatomical object, wherein firstly two or more diagnostic image data records (1, 3, 4, 5) of the object are recorded. Thereafter, an imaging specification is defined for imaging the image data (1, 3, 4, 5) onto a two-dimensional display plane (8), wherein in order to define the imaging specification anatomical features (2) of the object are identified in at least one of the image data records (1). Finally, a combined two-dimensional representation is calculated by imaging the two or more image data records (1, 3, 4, 5) according to the previously defined imaging specification onto a common display plane (8).

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MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Method for the computer-assisted visualization of diagnostic image data

The invention relates to a method for the computer-assisted visualization of a three-dimensional anatomical object, wherein at least two diagnostic image data records of the object are recorded and processed.

The invention furthermore relates to a diagnostic imaging device for carrying out the method and to a computer program for such a diagnostic imaging device.

In the field of angiography, two-dimensional X-ray projection methods are routinely used nowadays to show blood vessels by injecting suitable contrast agents. More recently, however, three-dimensional angiographic imaging methods are becoming increasingly important, such as three-dimensional X-ray imaging (CT) or magnetic resonance imaging (MR). The volume image data obtained by such methods contain interesting morphological information for diagnosing vascular disorders, such as stenoses or aneurysms for example. The visualization of the recorded vascular structures is important in both two-dimensional and three-dimensional medical imaging methods so that a treating physician can rapidly and reliably detect potential sources of risk (e.g. risk of infarct, thrombosis, or a risk that an aneurysm will burst).

Modern computer-assisted visualization methods make it possible on the one hand to show the course of blood vessels with high accuracy, wherein it may be possible to screen out any anatomical structures that do not belong to the vascular system of interest. Moreover, computer-assisted visualization methods are also a useful aid when planning interventions, such as percutaneous transluminal coronary angioplasty (PTCA) for example.

Furthermore, two- and three-dimensional imaging methods are known which are used not so much to clarify the morphology of blood vessels, as in the case of the above-described angiography methods, but rather make it possible to examine the function of an organ, for example the heart, which is supplied by the corresponding blood vessels. Such methods may be used in addition to angiographic methods to diagnose for example coronary vessel disorders. Methods are known in which temporal series of two- or three-dimensional diagnostic image data records of the heart are recorded and evaluated in order to discover

functional disorders of the myocardium. For this purpose, regions of the myocardium which differ from the normal function are identified in the recorded image data. This may be assessed for example on the basis of thickened or thinned areas of the heart wall or even on the basis of observed abnormal movements of the heart wall. Moreover, functional imaging methods are known, such as the so-called MR perfusion method for example, which allow the blood flow through the myocardium to be examined. In the MR perfusion method, a parameter image is generated on the basis of a temporal sequence of MR images, wherein it is calculated, for each pixel, how the concentration of an applied contrast agent changes over time at the position of the respective pixel.

In order to allow simple and reliable diagnosis, it is desirable when visualizing diagnostic image data to combine morphological (e.g. angiographic) image data with functional image data in a joint representation, specifically such that pathological changes in morphology can be directly placed in relation with corresponding functional disturbances. Thus, a representation is to be possible for example which can be used by the treating physician to assign a stenosis that can be detected in an angiographic image to incorrect function in a corresponding region of the myocardium. For this purpose, in US 5 151 856 it is proposed, starting from three-dimensional diagnostic image data records recorded by means of MR or CT, firstly to calculate a three-dimensional model of the examined myocardium using a computer. Based on this model, the functions in the various regions of the myocardium are then examined. In addition, two-dimensional angiographic projection images are recorded which show a two-dimensional representation of the morphology of the coronary arteries. Finally, the calculated model of the myocardium is visualized as a three-dimensional representation, wherein the recorded angiogram is superposed on this representation. To do this, the angiogram is suitably scaled and aligned in order to show the anatomical conditions in a manner that is as close to reality as possible. Regions of the myocardium in which functional disturbances have been identified can be emphasized using color according to the previously known method. The known method thus makes it possible to directly assign functional disturbances of the heart to visible morphological changes in the coronary arteries.

One particular disadvantage of the previously known method is that the superposition of the two-dimensional angiogram and the three-dimensional view of the heart model is not very well defined in geometric terms, and this leads to inaccuracies and errors which have a negative effect on diagnosis. Another disadvantage is that the three-dimensional view of the heart model, which in the previously known method is generated by

a so-ealled rendering algorithm known per se, is not optimal for allowing standardized depiction, e.g. in medical reports. Moreover, the reproducibility of the three-dimensional visualization is not always satisfactory since the concrete representation depends on a large number of individually adaptable parameters. For these reasons, the doctors involved find such three-dimensional views rather undesirable.

On this basis, it is an object of the invention to provide a method for computer-assisted visualization which allows a combined representation of two or more diagnostic image data records, wherein the representation is to be precisely defined in geometric terms and exactly reproducible. Moreover, a three-dimensional view of the anatomical features contained in the image data records is to be avoided.

This object is achieved according to the invention by a method as claimed in patent claim 1. According to the invention, firstly two or more diagnostic image data records of the anatomical object that is to be visualized are recorded. Thereafter, an imaging specification is defined for imaging the image data onto a two-dimensional display plane, wherein in order to define the imaging specification anatomical features of the object are identified in at least one of the image data records. Finally, a combined two-dimensional representation is calculated by imaging the two or more image data records according to the previously defined imaging specification onto the common display plane.

It is essential that the method according to the invention completely omits the generation of a three-dimensional view of the three-dimensional anatomical object that is to be visualized. As a result, the above-described disadvantages due to the three-dimensional representation are largely avoided. Instead, according to the invention a two-dimensional representation is calculated, specifically according to an imaging specification which is determined uniformly and in a geometrically well-defined manner, taking account of the anatomy shown by the image data, for all the image data records that are to be jointly visualized. The purely two-dimensional representation also has the advantage in particular of being able to be depicted in a standardized and reproducible manner, for example in medical reports.

When defining the imaging specification, for example the projection geometry for a projection of the image data onto the common display plane may be defined. In this case, use may be made of the so-called "soap bubble" method in expanded form which is known per se from the prior art (cf. Etienne et al., "Soap Bubble" Visualization and

Quantitative Analysis of 3D Coronary Magnetic Resonance Angiograms, Magnetic Resonance in Medicine, Volume 48, page 658, 2002). The soap bubble algorithm then receives its parameters by virtue of the identification according to the invention of the anatomical features contained in the recorded image data records. One important fundamental idea of the invention is accordingly to define the imaging specification according to the anatomy identified using the image data. The identification of the anatomical features for defining the imaging specification may be carried out both interactively, for example by a user of a corresponding imaging device, or else automatically by means of recording algorithms known per se.

It is also particularly important that in the method according to the invention – both when identifying the anatomical features and when calculating the joint two-dimensional representation – the relative spatial arrangement of the image areas covered in each case by the recorded image data records is taken into account. The spatial positioning of the individual image areas takes place during planning of the actual recording of the diagnostic images, e.g. in the case of MR imaging, usually once so-called scout image data records have been recorded. The latter are low-resolution anatomical image data records which cover the entire examination volume of interest. The manual or automatic positioning of the image areas on the basis of the scout image data records then supplies the necessary geometric information to be able to compare the diagnostic image data with one another in spatial terms and display them together according to the invention.

One advantageous development of the method according to the invention is obtained as claimed in patent claim 2, wherein in order to define the imaging specification an object volume delimited by a curved surface is determined in which the anatomical features of the object that are to be identified in the image data records are contained. The surface shape of the object volume may be shaped in a manner corresponding to the shape of the anatomical object to be examined, for example the heart or another organ. The surface of the object volume is for example firstly adapted to the outer contours of the anatomical object. The imaging specification then results from the result of this adaptation, according to which imaging specification the anatomical features contained in the object volume are projected, for example as claimed in patent claim 3. The image data lying outside the object volume are screened out. One possibility for adapting a curved surface which delimits an object volume to the outer contours of the anatomical object (the heart) to be examined is described in the abovementioned document by Etienne et al. One alternative possibility for calculating the two-dimensional representation consists, as claimed in patent claim 4, in assigning Cartesian

coordinates within the display plane to non-Cartesian surface coordinates of the object volume. The object volume may for example have an ellipsoid shape. The surface of the ellipsoid can then be parameterized by polar coordinates. In order to display the projection in a two-dimensional manner on the surface of the object volume, the polar coordinates can be converted into corresponding Cartesian coordinates in a particularly simple manner. The imaging specification is thereby clearly defined in geometric terms, although account should be taken of the fact that distances between anatomical features of the object cannot be reproduced in a realistic manner. In principle, there may be used in the method according to the invention any type of imaging by means of which any curved surface in three-dimensional space is imaged onto a two-dimensional display plane.

As claimed in patent claim 5, the method according to the invention may advantageously be used for the combined displaying of morphological and functional image information relating to the examined anatomical object. In this case, the precisely defined imaging specification for imaging the image data onto the two-dimensional display plane is a prerequisite to it being possible for pathological changes that can be detected in the morphological image data to be reliably assigned to corresponding disturbances that can be detected in the functional image data. As claimed in patent claim 6, the functional image information may be obtained, as in the abovementioned MR perfusion method for example, by evaluating temporal sequences of morphological image data of the anatomical object. This is possible in particular when using the method according to the invention to examine coronary vessel disorders since, as mentioned above, incorrect functions of the myocardium can be successfully determined by assessing the wall thickness and the movement of the myocardium.

As claimed in patent claim 7, in the method according to the invention at least one of the image data records comprises a slice image of the anatomical object. Accordingly, the method according to the invention can be used to combine a number of slice images in a joint two-dimensional representation.

As claimed in patent claims 8 and 9, in the method according to the invention the image data records may be recorded by means of computer tomography, magnetic resonance or ultrasound. There is also the possibility of using different imaging modes to record the image data records. According to the invention, it is thus possible for example for image data obtained by ultrasound to be combined with MR image data in a joint representation.

A diagnostic imaging device as claimed in patent claim 10 is suitable for carrying out the method according to the invention. Said diagnostic imaging device has recording means for recording three-dimensional image data records of an anatomical object, and computer means for visualizing the image data. The computer means are provided with program control, by means of which the above-described method according to the invention can be carried out.

The method according to the invention may be made available to the users of such diagnostic imaging devices in the form of a corresponding computer program. The computer program may be stored on suitable data carriers, such as CD-ROMs or floppy disks for example, or it may be downloaded via the Internet onto the computer means of the imaging device.

The invention will be further described with reference to examples of embodiments shown in the drawings to which, however, the invention is not restricted.

Fig. 1 shows a schematic diagram of the progress of the method according to the invention.

Fig. 2 shows an MR device according to the invention.

Fig. 1 shows the method according to the invention on the basis of a cardiological MR examination for assessing the morphology and functional condition of the heart of a patient. The method begins with the recording of various diagnostic image data records of the heart. Fig. 1 shows at the top the diagram of an image data record 1 which is recorded by means of three-dimensional MR coronary artery imaging. The course of the coronary arteries 2 within the image data record 1 can be seen in Fig. 1. Moreover, three functional slice images 3, 4 and 5 of the myocardium are produced by means of the abovementioned MR perfusion technique. The slice images 3, 4 and 5 show for each pixel the respective flow of blood through the myocardium in a plane perpendicular to the longitudinal axis of the heart. With reference to the top and middle diagrams of Fig. 1, it can be seen how the image data records 1, 3, 4 and 5 are spatially arranged relative to one another within an examination volume 6. This relative spatial arrangement is either defined by planning the recording of the images or must be determined subsequently, for example using suitable recording algorithms.

The definition of an imaging specification for imaging the image data 1, 3, 4 and 5 onto a two-dimensional display plane is shown in the middle diagram of Fig. 1. In order to define the imaging specification, in the example of embodiment the shape, the position and the orientation of an ellipsoid object volume 7 are adapted to the anatomical features of the heart, which can be seen from the image data records 1, 3, 4 and 5. The longitudinal axis of the ellipsoid 7 in this case approximately corresponds to the heart axis, and the surface of the ellipsoid 7 roughly corresponds to the outer contour of the myocardium. According to the imaging specification, the image information of the data records 1, 3, 4 and 5 which is contained in the object volume 7 is projected onto the surface of the ellipsoid 7. The ellipsoid shape is selected here only for the purpose of illustration. Other surface shapes may be selected depending on the anatomy to be examined. In order to define the imaging specification, it is also possible for example for the coronary arteries 2 to be identified by means of a suitable recording algorithm.

In the next step, the actual visualization of the image data takes place, and this is shown in the bottom diagram in Fig. 1. In the example of embodiment, a combined two-dimensional representation is calculated by imaging the image data records 2, 3, 4 and 5 according to the previously defined imaging specification onto a common display plane 8. For this purpose, Cartesian coordinates within the display plane 8 are assigned to the polar coordinates θ and φ by means of which the surface of the ellipsoid object volume 7 is parameterized. The morphology of the coronary arteries 2 can be seen very well in the two-dimensional representation. In particular, it can be seen in this representation that one of the vessels has a stenosis 9. The projections of the slice images 3, 4 and 5 in the display plane 8 show a lack of blood flow through the myocardial tissue in a region 10. Using the two-dimensional representation generated according to the invention, the treating physician can thus directly assign the pathological change 9 to the functional disturbance in the regions 10.

The diagnostic imaging device shown as a block diagram in Fig. 2 is an MR device of conventional design. The MR device consists of a main field coil 11 for generating a homogeneous static magnetic field in an examination volume in which a patient 12 is located. The MR device furthermore has gradient coils 13, 14 and 15 for generating magnetic field gradients in different spatial directions within the examination volume. The computer means of the diagnostic imaging device shown are formed by a central control unit 16 which is connected to the gradient coils 13, 14 and 15 via a gradient amplifier 17. The temporal and spatial profiles of the magnetic field gradients within the examination volume are controlled thereby. The image recording means of the MR device include a high-frequency coil 18

which is used to generate high-frequency fields in the examination volume and to receive MR signals from the examination volume. The high-frequency coil 18 is connected to the control unit 16 via a transmitting unit 19. The MR signals received by the high-frequency coil 18 are demodulated by a receiving unit 20 and amplified and fed to a reconstruction and visualization unit 21 which likewise belongs to the computer means of the diagnostic imaging device. The MR signals processed by the reconstruction and visualization unit 21 can then be displayed by a screen 22 in the manner according to the invention. The reconstruction and visualization unit 21 and the control unit 16 have suitable program control for carrying out the above-described method.

CLAIMS:

1. A method for the computer-assisted visualization of a three-dimensional anatomical object, comprising the following method steps:

a) recording two or more diagnostic image data records (1, 3, 4, 5) of the object;

b) defining an imaging specification for imaging the image data (1, 3, 4, 5) onto a two-dimensional display plane (8), wherein in order to define the imaging specification anatomical features (2) of the object are identified in at least one of the image data records (1);

c) calculating a combined two-dimensional representation by imaging the two or more image data records (1, 3, 4, 5) according to the previously defined imaging specification onto the common display plane (8).

2. A method as claimed in claim 1, wherein in order to define the imaging specification an object volume (7) delimited by a curved surface is determined in which the anatomical features (2) of the object that are to be identified are contained.

3. A method as claimed in claim 2, wherein according to the imaging specification a projection of the image information of the data records (1, 3, 4, 5) that is contained in the object volume (7) is calculated during the calculation of the two-dimensional representation.

4. A method as claimed in claim 3, wherein in order to calculate the two-dimensional representation Cartesian coordinates within the display plane (8) are assigned to non-Cartesian surface coordinates (U, φ) of the object volume (7).

5. A method as claimed in any of claims 1 to 4, wherein at least one image data record comprises morphological image information of the anatomical object and at least one further image data record (3, 4, 5) comprises functional image information relating to the anatomical object.

6. A method as claimed in claim 5, wherein the functional image information is obtained by evaluating temporal sequences of morphological image data of the anatomical object.

7. A method as claimed in any of claims 1 to 6, wherein at least one of the image data records (3, 4, 5) comprises at least one slice image of the anatomical object.

8. A method as claimed in any of claims 1 to 7, wherein the image data records are recorded by means of computer tomography, magnetic resonance or ultrasound.

9. A method as claimed in any of claims 1 to 8, wherein the image data records are recorded using different imaging modes.

10. A diagnostic imaging device with recording means (18, 20) for recording three-dimensional image data records of an anatomical object (2), and with computer means (16, 21) for visualizing the image data, wherein the computer means (16, 21) have program control, by means of which a method as claimed in any of claims 1 to 9 can be carried out.

11. A computer program for a diagnostic imaging device, wherein a method as claimed in any of claims 1 to 9 is implemented by the computer program on the computer means (16, 21) of the imaging device.

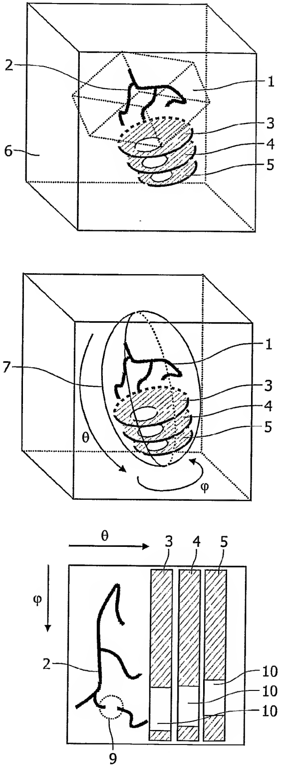

FIG.1

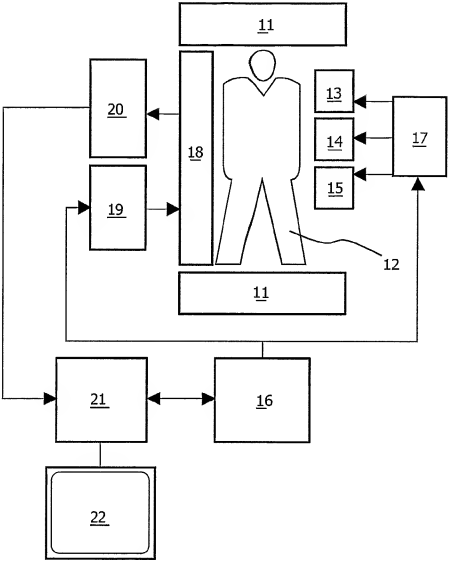

FIG.2

INTERNATIONAL SEARCH REPORT

IB2004/052731

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06T17/40

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX, IBM-TDB, BIOSIS, EMBASE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GRAVES EDWARD E ET AL: "Registration of magnetic resonance spectroscopic imaging to computed tomography for radiotherapy treatment planning" MEDICAL PHYSICS, AMERICAN INSTITUTE OF PHYSICS. NEW YORK, US, vol. 28, no. 12, December 2001 (2001-12), pages 2489-2496, XP012011359 ISSN: 0094-2405	1-3,5, 7-11
A	abstract chapters I., II. figures 3,4	4,6
X	US 6 351 573 B1 (SCHNEIDER M. BRET) 26 February 2002 (2002-02-26) abstract column 5, line 15 - column 7, line 4	1,5,7-11
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 March 2005	23/03/2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Engels, A

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	BULLITT E ET AL: "Analysis of time-varying images using 3D vascular models" APPLIED IMAGERY PATTERN RECOGNITION WORKSHOP, AIPR 2001 30TH WASHINGTON, DC, USA 10-12 OCT. 2001, LOS ALAMITOS, CA, USA,IEEE COMPUT. SOC, US, 10 October 2001 (2001-10-10), pages 9-14, XP010584335 ISBN: 0-7695-1245-3 abstract figures 1,6	1,5,7-11
A	ETIENNE A., BOTNAR R.M., VAN MUISWINKEL A.M.C., BOESINGER P., MANNING W.J., STUBER M.: ""Soap-Bubble" Visualization and Quantitative Analysis of 3D Coronary Magnetic Resonance Angiograms" MAGNETIC RESONANCE IN MEDICINE, vol. 48, 26 September 2002 (2002-09-26), pages 659-666, XP002319890 cited in the application abstract section "Reformatting"	1-11

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 6351573	B1	26-02-2002	US	5531227 A	02-07-1996
			DE	69532916 D1	27-05-2004
			EP	0741540 A1	13-11-1996
			JP	9508994 T	09-09-1997
			WO	9520343 A1	03-08-1995